

Notes on some Habits of the Scorpions *Androctonus funestus*, Ehr., and *Euscorpis italicus*, Rocs. By E. RAY LANKESTER, M.A., F.R.S., Jodrell Professor of Zoology in University College, London.

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I. OBSERVATIONS ON ANDROCTONUS FUNESTUS.

Early in last November I received from Biskra, in the south of Algeria, through the kindness of Professor Carl Vogt, six living specimens of the beautiful citron-coloured Scorpion, *Androctonus funestus*. A cage, measuring 3 ft. by 4 ft., and covered above by glass, was prepared for them. The cage was kept at a temperature of 65° Fahr. by means of gas, and some six inches in depth of fine sand and gravel was placed on the floor of the cage.

The Scorpions were all active enough after their journey, which they had made whilst packed in sand. All were full-grown, measuring three inches and a half from the front margin of the cephalic shield to the anus, excepting one which was about half this size. This small specimen was found torn into two pieces, and the soft tissues sucked out of the integument, on the day after the arrival of the specimens. The other five lived about four months: one died without apparent cause; a second was killed, and its soft tissues consumed by its companion; whilst the other three were killed for dissection and experiment.

Burrowing in Sand.—A pan of water was placed in the cage with the Scorpions, but the Scorpions were never seen to visit it. They preferred the drier parts of the sand, in which they buried themselves, excavating each a tunnel for its own habitation. These tunnels were often as much as eight inches in length, and ran horizontally just below the surface of the sand. In consequence of the sand having become caked by the sprinkling of water on its surface, the Scorpions were able to work upon it in the way mentioned.

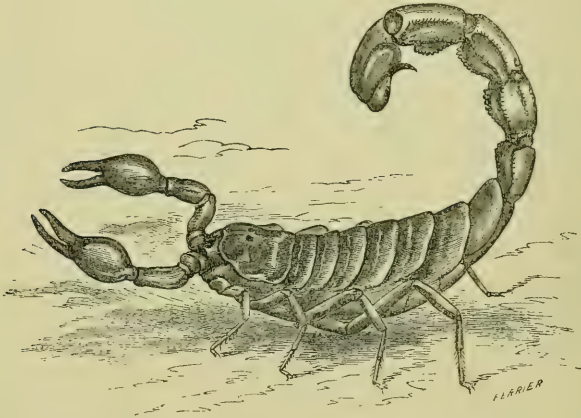
The process of excavation was observed on several occasions. The Scorpion commenced by pushing the large chelæ into the sand, and scraping backwards with the three anterior pairs of walking-legs; whilst the hindmost pair of walking-legs did not share in this movement, but remained motionless, acting as a

support for the body. The scraping action was very rapid, the sand being thrown out by the quick strokes of the three pairs of legs in a constant shower, and to a distance of three or four inches, so as to produce a curious rattling sound.

The use of the legs in burrowing in this species of Scorpion is interesting to compare with the parallel but not identical use of the legs in *Limulus*. *Androctonus funestus* is, it should be observed, distinctly an inhabitant of sandy regions, to which fact its pale yellow colour is related.

General Carriage in Locomotion and Mode of using the Sting.—These Scorpions were by no means courageous, but, on the contrary, very timid. During the daytime they were always hidden in their burrows, or under the water-pan, or pieces of wood. If brought to the surface, they gave very little evidence of sight, and none of hearing, and endeavoured as rapidly as possible to hide themselves again. The carriage is remarkable, differing much from that of *Euscorpium carpathicus* and *E. italicus*. The

Fig. 1.



Androctonus funestus, var. *citrinus*, Ehr.
Drawn from the living animal, March 1882.

body is well raised from the ground, the tail reflected over the back, and the sting carried just over the back of the cephalic shield, ready to give a forward stroke, whilst the large chelæ are widely outstretched and held horizontally, acting most obviously as tactile organs, the creature feeling its way with them: The

movement is very steady, giving the impression of something on wheels, and is never rapid—never so rapid as to escape a man's complete control. They could be handled with impunity if *rapidly* seized by the last joint of the tail; but if *slowly* approached, a vigorous stroke was delivered at the approaching object by the tail, directed so as to give the sting effect. Complete directive power exists in regard to these movements of the tail. The blow can be delivered either straight forwards over the head, straight backwards, or to the right or to the left. In this particular species the tail is relatively far larger and more powerful than in any other Scorpion, and its blows (as tested against a piece of wood) are of very great strength.

Capture of Prey.—I had some difficulty in feeding these Scorpions. They appeared not to care for such small game as blowflies. Some newly-born white mice were appreciated by two out of the five; and they all took, at different times, the large ship's cockroaches which were placed in quantity in the cage with them, though they would not touch the common blackbeetle. They never fed excepting at dusk or in the night; so that it was difficult to observe their proceedings. But on two occasions I saw cockroaches attacked. Probably the Scorpion never *pursues* its prey, but comes upon it by stealth. The cockroaches walked unsuspectingly up to the Scorpion when I was observing the cage with a light just after dark, and suddenly one was seized by the large left chela of the Scorpion; at the same moment the sting was swiftly brought over the Scorpion's head, and *two* stabs in quick succession were administered to the cockroach*. The Scorpion then carried off its prey, *holding it in the large chela*. Having found a quiet place in which to feed, the Scorpion tore off the head of the cockroach by means of its chelæ, and *then inserted the chelicerae* into the soft substance of its prey. The struggles of the cockroach had lasted about two minutes; and not until they had ceased did the Scorpion release the hold of it by his large chela and commence the feeding operation. When *now* disturbed the Scorpion did not carry his food by means of one of the large chelæ as before, when that food was still alive and struggling. *Now* he carried the dead cock-

* The poison-gland of the Scorpion is double: each gland is invested by a powerful muscle, the contraction of which expels the poisonous secretion. I have studied the structure of the Scorpion's sting and poison-gland by means of sections prepared for me by my assistant, Mr. A. G. Bourne, B.Sc.

roach held firmly by the chelicerae, and thus left his chelae free for attack or defence. I observed this on other occasions: a Scorpion, when disturbed feeding, always carries off its prey held in the chelicerae, leaving the chelae free for other uses.

Mode of ingestion of Food.—The exact mode of bringing the food into the mouth is, naturally enough, very difficult to observe. The mouth of the largest Scorpions existing is a minute aperture not so broad as the shank of an ordinary pin; and food is drawn into this aperture by a remarkable pumping action of the pharynx, the mechanism of which has been described by Professor Huxley*. The chelicerae, though short, are in all Scorpions provided with exceedingly powerful muscles, and the surfaces corresponding to the cutting-edges of a pair of nippers are not simply cutting-surfaces, but are broad, and fitted rather for crushing than cutting. On one occasion I was able to observe the chelicerae at work, when the Scorpion was feeding upon a young mouse. Each chelicera was protruded, and then withdrawn alternately with its fellow, first the right and then the left, the retraction tending to bring down towards the mouth the soft tissues of the mouse. The range of protrusion and retraction of the chelicera is about equal to its total length. During this process the chelicerae were grasping the intestine and mesentery of the mouse, and the alternate movement of the right and left sides suggested the action of "milking."

Although these Scorpions always left large portions of the hard substances of their prey unconsumed, and though, from the structure of the mouth, it is clear that no large particles of hard substance can be taken into the alimentary canal, yet it is a fact that a considerable portion of the chitinous cephalic shield, and dorsal sclerites also, of the Scorpion which fell a victim to one of its fellows was destroyed, and apparently had been consumed by the cannibal. The edge of the remnant of the cephalic shield was notched, as would have been the case had it been crushed by the chelicerae of the attacking Scorpion; and I am led to the conclusion that, by the aid of the short crushing nippers constituted by the chelicerae, the larger Scorpions may pulverize very dense substances, and subsequently introduce them into the very narrow oral aperture by suction.

Swelling after Food.—The Scorpion which fed upon its companion became as a consequence greatly distended, the soft in-

* Quart. Journ. Micr. Sci. 1860, p. 250.

tegument between the dorsal and ventral sclerites of the mesosoma being stretched until quite tense. It seems to be a legitimate conclusion that the food-matters sucked in by the Scorpions are not retained simply in the narrow median tract of the alimentary canal, but pass into the wide canals of the gastric cæca (so-called liver), where probably they are chemically changed and absorbed.

Excrement.—The contents of the intestine of the Scorpion (*i. e.* the part of the gut which lies in the tail) were always found by me to be white and opaque, consisting of a fine moist powder. Whether this powder was derived from the Malpighian tubes or consisted truly of fæces, I am unable at present to say. No fæces were observed to be deposited by the *Androctonus* whilst in my possession.

The Combs as Sense-organs.—On several occasions I made experiments on the tactile sense of the combs or pectiniform appendages. They appeared to me to possess no special sensitiveness. When they were pinched with forceps, the Scorpion showed no evidence of discomfort. It is quite possible that they may acquire a heightened sensibility at the breeding-season, and serve as guides to the male and female in effecting copulation.

Suicide of Scorpions.—The well-attested statement that a Scorpion when placed within a ring of red-hot embers will, after making futile efforts to pass the fiery circle which surrounds it, deliberately kill itself by inflicting a wound with its sting in its own head, has often been doubted. When killing a Scorpion (*A. funestus*) in a glass box by the use of chloroform vapour, I witnessed something which tends, I think, to throw light on the old tradition, and to confirm its accuracy in the main. As soon as the Scorpion began to feel the effects of the chloroform-vapour, it made repeated blows with its sting in the straight, forward direction above its head. These blows became gradually less definite, and the muscular movements concerned in them less efficiently coordinated. At last one blow was so ill-directed as to cause the tip of the Scorpion's sting to catch under the free projecting margin of the posterior region of the cephalic shield. In this instance the Scorpion did not lacerate itself; but I can well believe that occasionally such a misdirected blow with the sting on the part of a half-suffocated Scorpion has

been seen to cause a penetration and laceration of the cephalic shield, followed by the death of the Scorpion*.

II. OBSERVATIONS ON EUSCORPIUS.

For repeated sendings of a large number of Italian Scorpions belonging to the species *E. italicus*, *E. carpathicus*, and *E. flavicaudus*, I am indebted to the great kindness and energy of Mr. Gibson-Carmichael.

Carriage and General Habits.—It is worthy of remark that these small Italian Scorpions (all very closely allied, if, indeed, really distinct, species) are much flatter in the body than *Androctonus funestus*, and that the body is not raised on the legs in walking as in the latter species, but lies close to the ground, the legs being extended on either side. Concurrently with this habit, we find that these Scorpions are more given to pushing themselves under stones and into crevices than is *A. funestus*, and apparently do not make burrows for themselves. The tail is rarely if ever raised over the back as in *Androctonus funestus*; it is dragged behind with the slightest upward curvature only, or a curvature to the right or left. Only under great provocation are blows delivered by the sting if the animal be handled, and these are usually ineffective.

Frequently I have found them under stones in the cage in which I kept them, with the *ventral* surface turned uppermost. In fact this position is more usual than the reverse. I am at a loss to explain the significance of this attitude, unless it be that my specimens were under observation during the spring (March, April, May), and that at this time copulation takes place, when, as has been observed by others, and as is necessary from the position of the copulatory organs, the one sex receives the other in the position described, viz. with the ventral surface turned upwards.

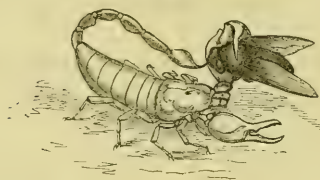
Fighting.—A large number of these Scorpions being placed together in a glass box, some came into conflict one with another. In such conflicts the large chelæ were used, the one seizing with these organs the corresponding organs of the other. But the sting was never brought into use in these contests.

Capture of Prey.—These small Scorpions feed readily on the

* In any attempt to test the accuracy of the statements made as to suicide by Scorpions, it is of great importance to distinguish the species observed. The Spanish Scorpion, concerning which the tradition exists, is an *Androctonus* (*A. occitanus*) allied to *A. funestus*.

bluebottle-fly; they will also take the larvæ and pupæ of the same insect. On several occasions I have witnessed the whole process of capture and killing of such a fly. As with *Andro-*

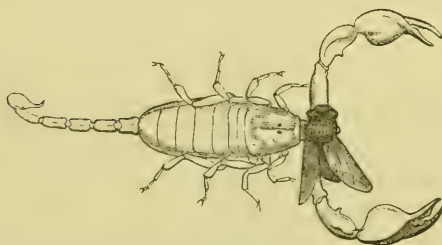
Fig. 2.



Euscorpium piercing fly's head with its sting.

ctonus so with *Euscorpium*, the prey came to the Scorpion by no exercise of agility on the part of the latter, but simply through the carelessness of the fly, who practically walked into the Scorpion's arms. Thereupon the Scorpion firmly grasped the

Fig. 3.



Sketch showing *Euscorpium* using its chelicerae when sucking the juices of the fly, and the manner in which this genus carries its tail, only slightly bent.

fly with his left large chela, and very deliberately, whilst the fly buzzed and struggled, brought up his sting over his head, and carefully pierced the fly's head with his long, fine sting. Having deliberately withdrawn his sting, he again quietly, and with an air of much determination, again introduced the fine sting into the fly's head. The slowness of this stinging process is perhaps to be connected with the fact that the poison-glands have to be compressed by their proper muscles, and the poison squeezed out of the lumen of the gland after the sting has pierced the fly's head.

Having accomplished this operation the Scorpion walked

round with the fly (still struggling), held in his left chela. After three minutes the movements of the fly ceased. Then the Scorpion brought the fly up to its chelicerae, and released its hold with the left chela. The fly was now carried by the two chelicerae, the chelæ being left free. I did not observe in these small Scorpions any thing of the method of getting out the juices of their prey.

I am inclined to think that the species of *Euscorpium* do not so readily prey upon their own kind as does *Androctonus funestus*, and as does the Spanish Scorpion allied to *A. funestus*, namely the *A. occitanus*, or yellow Scorpion of Southern France and Spain*. According to Maupertuis, in six weeks one hundred of these *A. occitanus*, kept by him in a cage, were reduced in number to ten, one having eaten another, until at last only these few, presumably the embodiment of the whole hundred, were left.

I trust that these few fragmentary observations may induce others, who have enjoyed greater opportunities, to place on record their experiences as to the habits of various species of these notable and historic Arachnids.

On the Butterflies collected by Lord Walsingham in California.

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(Read March 2, 1882.)

THE collection of which the following is an account consists of about eighty species obtained by Lord Walsingham during the years 1871 and 1872 in California, one species only (which I believe to be the *Thecla auretteorum* of Boisduval) being taken in Oregon. Compared with other collections from this country, the present is by no means poor in species: the first series forwarded by M. Lorquin to Dr. Boisduval contained 83 species of Butterflies; but some of these may have been received from Mr. Doubleday, since Dr. Boisduval says:—"Toutes les espèces mentionnées dans cet opuscule ont été recueillies par M. Lorquin, à l'exception de cinq à six, qui nous ont été données par M.

* Since writing the above, I have found three small *Euscorpium*, killed and their juices sucked, in a box sent to me containing eight live specimens when despatched from Italy.